

Is Action Planning Helpful for Smoking Cessation? Assessing the Effects of Action Planning in a Web-Based Computer Tailored Intervention

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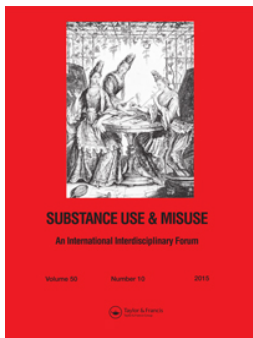
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ORIGINAL ARTICLE

Is Action Planning Helpful for Smoking Cessation? Assessing the Effects of Action Planning in a Web-Based Computer-Tailored Intervention

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Background and objectives: The aim of this study was to examine the efficacy of a web-assisted computer-tailored smoking cessation intervention, an action planning (AP) intervention in which potential quitters were encouraged to form action plans (e.g., plan a quit date) and execute them (e.g., remove ashtrays). We also investigated whether the AP intervention resulted in more AP and plan execution than a similar, control intervention without the supplementary AP component. **Methods:** In a randomized controlled trial, the AP intervention ($N = 977$) was compared with the control intervention ($N = 1,005$) in terms of self-reported continued abstinence (CA) and point prevalence abstinence (PPA) six months after baseline. AP, plan execution, and opinion of the intervention were measured one month after baseline. **Results:** Complete-case logistic regression analysis showed that the AP intervention had a significant effect on CA (OR = 2.01; CI 1.08–3.84, $p = .02$), whereas intention-to-treat analysis showed a borderline significant effect (OR = 1.68; CI .96–2.92, $p = .07$). Sixteen percent of the experimental group achieved CA compared to 10% of the control group. The AP intervention had no effect on PPA. The experimental group also showed significantly more AP and plan execution at one month. Execution of plans was associated with smoking cessation. **Conclusions:** The effects of the AP intervention on CA, AP, and execution of plans were encouraging. The potential for widespread use of web-based interventions means that even small behavioral effects may have an impact on

public health. We recommend that the intervention be intensified and improved.

Keywords action planning, smoking cessation, web-based intervention, coping planning, computer tailoring

INTRODUCTION

Most smokers (75%) want to quit smoking (ITC project, 2010; Reid, Hammond, Boudreau, Fong, & Siahpush, 2010) but only a small proportion make a quit attempt (e.g., ITC project, 2010; Reid et al., 2010) and only 5% succeed (Fiore et al., 2008; Hughes, Keely, & Naud, 2003a). Although there is good evidence for the effectiveness of behavioral interventions (for overviews see, e.g., Civljak, Stead, Hartmann-Boyce, Sheikh, & Car, 2013; Fiore et al., 2008), smokers who want to quit often do not use smoking cessation aids (Borland et al., 2012; Willems, Willemsen, Nagelhout, & de Vries, 2013). This makes it important to develop easily accessible smoking cessation interventions.

The Internet has a high potential for delivering smoking cessation support because of its accessibility, potentially large reach, and relatively low cost per user. Recent meta-analyses and reviews concluded that web-based interventions—especially interactive ones including automated tailored feedback—contribute to smoking cessation (Civljak et al., 2013; Hutton et al., 2011; Krebs, Prochaska, & Rossi, 2010; Myung, McDonnell, Kazinets, Seo, & Moskowitz, 2009; Rook, Thorsteinsson, Karpin, Copeland, & Allsop, 2010; Shahab & McEwen, 2009).

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However, the effectiveness of interventions is variable. It is not clear what the optimal web-based smoking cessation program should include.

Computer tailoring (CT) has been shown to be an effective approach to web-based smoking cessation interventions (Stanczyk et al., 2014; Strecher, Shiffman, & West, 2005; Te Poel, Bolman, Reubsaet, & de Vries, 2009). In CT interventions, individuals complete a diagnostic questionnaire on issues relevant to smoking cessation (e.g., their expected self-efficacy with regard to quitting), then they automatically receive personalized advice on these topics.

In order to improve web-based CT smoking cessation interventions, it is important to analyze how behavior change techniques may contribute to their effectiveness. This paper reports on a randomized controlled trial (RCT) intended to reveal the contribution of an action planning (AP) component to the effectiveness of a web-based CT smoking cessation intervention.

AP is a term used to describe the development of strategies for reaching and maintaining a specific behavioral change goal (Abraham, Sheeran, & Orbell, 1998; de Vries, Eggers, & Bolman, 2013; Gollwitzer, 1996; Michie, Hyder, Walia, & West, 2011). AP could be an effective behavioral change strategy because many smokers intend to quit smoking but have difficulty translating this intention into action. AP is assumed to bridge the intention-behavior gap (Gollwitzer & Sheeran, 2006; Locke & Latham, 2002; Sniehotka, 2009).

Descriptions of AP in the literature vary slightly; the operationalization used in this study is derived from the I-Change model (de Vries, Mesters, van de Steeg, & Honing, 2005; de Vries et al., 2006). AP comprises goal-setting strategies intended to translate intentions into specific action plans as preparation for behavioral change (preparatory planning) and in order to sustain behavioral change in challenging situations (coping plans) and ensure that these plans are executed (de Vries et al., 2013). Examples of action plans include "remove ashtrays from the house" (preparing for smoking cessation) and "drink a glass of water when craving a cigarette" (plan for coping with a difficult situation). There is some evidence that AP facilitates smoking cessation and prevents relapse (Brodbeck, Bachmann, & Znoj, 2013; de Vries et al., 2013; Elfeddali, Bolman, Candel, Wiers, & de Vries, 2012a, 2012b; Hilberink, Jacobs, Schlosser, Grol, & de Vries, 2006; Michie, Hyder, Walia, & West, 2011).

This leads to the question of AP could be integrated into CT interventions, what separate value it has in smoking cessation and whether receiving AP advice results in more development and execution of action plans. Planning actions intended to lead to behavioral change does not necessarily lead to the execution of these plans. It is execution of plans rather than AP, which predicts smoking cessation (de Vries et al., 2013). Current data on the effectiveness of AP interventions are ambiguous (Kwasnicka, Preece, White, & Sniehotka, 2013). Small positive effects were found in web-based coping-planning-relapse prevention interventions (Elfeddali et al., 2012b; van Osch, Lechner,

Reubsaet, Wigger, & de Vries, 2008) but these studies tested AP as part of a multi-component program. Some studies of face-to-face and paper-based AP interventions for smoking cessation showed significantly higher smoking abstinence in intervention groups compared with controls who received no intervention (Armitage, 2007, 2008; Armitage & Arden, 2008; Connor & Higgins, 2010; Web, Sheeran & Luszczynska, 2009), while others have failed to show an effect of AP (Higgins, & Conner, 2003; West, Walia, Hyder, Shalab, & Michie, 2010).

To determine the value of AP (i.e., information and advice on preparatory planning and development of coping strategies) in smoking cessation, we tested the effects of a web-based AP CT intervention. In a RCT, an AP CT intervention (see *Intervention* section) was compared to a similar intervention without the AP components. We also tested whether the AP intervention resulted in more AP. A previous study demonstrated that this web-based AP CT intervention was more effective in supporting smoking cessation than an untailored web-based intervention (Te Poel et al., 2009).

The main hypothesis was that a web-based CT intervention that included an AP component would have a greater beneficial effect on smoking cessation than the standard web-based CT intervention. We also hypothesized that the AP intervention would enhance AP and enactment of action plans. User evaluations of the two web-based CT interventions were compared; use and appreciation of the AP components was only assessed by participants receiving the AP CT web-based intervention.

METHODS

Ethical approval for this study was obtained from the Medical Ethics Committee of the Maastricht University. The study was registered in the Dutch Trial Register (NTR519).

Participant Recruitment, Procedure, and Design

An RCT with a baseline measurement and follow-up measurements one month and six months after baseline was conducted. Smokers who visited the website of Netherlands Foundation for a Smoke-free Future (was dissolved in January 2014) to request a tailored smoking cessation advice letter were invited to participate in a study in which they would receive one of two CT interventions. They were not informed about group assignment.

Participants completed an informed consent form on the website; they also could complete the online baseline questionnaire (T0) there. The computer program used for generating the tailored advice also randomly assigned participants to either the control group (standard intervention) or the experimental group (standard intervention + AP feedback (AP intervention)).

The online baseline questionnaire started with a check for eligibility. Participants were eligible if they were 18 years or older, smoked cigarettes and/or hand-rolling tobacco, and intended to quit smoking within one year. Potential participants who did not fulfill the enrolment

criteria received an onscreen message explaining why they could not participate. Immediately upon completing the baseline questionnaire, participants received the CT advice letter by e-mail (the letter was also displayed on the study website). One month (T1) and six months (T2) later, participants were invited to complete follow-up questionnaires. If they did not respond a maximum of two reminders was sent by e-mail.

Intervention

The information in the letters was tailored to the participant in accordance with his or her responses on the baseline questionnaire and varied according to group assignment. The letters addressed participants' perceptions of the pros and cons of quitting (e.g., decreased likelihood of lung cancer vs. experience of withdrawal symptoms) offered advice on how to deal with smokers in one's immediate social environment, for example, coping with a partner who smoked, and also included self-efficacy-enhancing and -reinforcing guidance.

Letters for the experimental group also included tailored advice on AP. This was based on the participant's response to questions about 17 predefined action plans (e.g., Do you plan to remove all tobacco products from the house?) in the baseline questionnaire. The project team selected the action plans on the basis of focus group interviews and a literature review. The advice on AP included:

- (1) Personalized information about the beneficial effects of the use of action planning and coping strategies.
- (2) Messages to invite and stimulate participants to think about personal pitfalls during a quit attempt and to prepare for these pitfalls (develop coping plans). The tailored letter also provided personalized advice on coping with situations that had been identified as high risk for the participant on the basis of his or her responses to questions about self-efficacy and relapse self-efficacy in the baseline questionnaire. Approximately 150 different AP related messages could be generated according to responses to the 17 action plan items and the relapse self-efficacy items. AP messages included, for example: "You indicated that you are not planning to use any smoking cessation aids in the process of quitting. Quitting is something that you have to do on your own, but the use of particular aids might help you."
- (3) A personalized action plan overview that set out the pre-defined action plans that the participant had indicated in the baseline questionnaire to intend to implement.
- (4) A sheet to write down personal IF THEN plans for coping with high-risk situations. Example IF THEN plans were provided, including: "IF I am visiting a bar shortly after starting my quit attempt, THEN I will drink no or a small amount of alcohol to avoid craving for cigarettes." This sheet also prompted participants to choose a reward they would give themselves after a period of smoking abstinence.

In both interventions the answers to the baseline questions were linked to stored, pre-written messages. The messages were subsequently combined to form a personalized seven-to-nine page CT e-mail letter. The letter in the control group was one page shorter.

Measurements

Baseline Measurements (T0)

Demographic variables assessed were sex, age, and education level (low: up to lower level vocational training degree; medium: secondary vocational training, general high school; high: higher vocational training, university). Presence of four smoking-related diseases (chronic obstructive pulmonary disease, COPD; cancer; diabetes; cardiovascular disease) was measured with four questions. Level of nicotine dependence was measured with the six-item Fagerström Test for Cigarette Dependence with an index score ranging from 0 to 10 (Fagerström, 2012; Heather-ton, Kozlowski, Frecker, & Fagerström, 1991). Previous quit attempts were also assessed.

The scales used to measure motivational factors relevant to smoking cessation had been used in previous studies (Dijkstra, de Vries, Roijackers, & van Breukelen, 1998a, 1998b; Hoving, Mudde, & de Vries, 2006; Te Poel et al., 2009). Attitude was assessed by responses to subscales on, respectively, the pros and cons of quitting. High scores indicated that the participant perceived, respectively, more benefits of quitting or sees more disadvantages to quitting. The subscale on the pros of quitting: 11 summed statements (Cronbach's $\alpha = .81$); e.g., "Quitting smoking would be beneficial to my health;" response scale ranging from: 0 = "no it would not be beneficial to my health" to 3 = "yes, it would be definitely beneficial to my health." The subscale on the cons of quitting: 9 summed statements (Cronbach's $\alpha = .62$); e.g., "If I quit smoking I will experience withdrawal symptoms;" response scale: 0 = "I will not experience any withdrawal symptoms" to 3 = "I will experience severe withdrawal symptoms." Social modeling was assessed by two statements, one asked whether children in the home smoked (-1 = "all or at least half smoke;" 0 = "not applicable;" 1 = "none or fewer than half smoke"), the other asked whether the participant's partner smoked (-1 = "yes;" 0 = "not applicable;" 1 = "no"). Self-efficacy was assessed by 16 items asking participants to indicate whether they would be able to refrain from smoking in various situations; responses were given on a five-point scale (range: 1 = "definitely not;" 5 = "yes, definitely;" Cronbach's $\alpha = .89$), a high score reflected high confidence in one's ability to refrain from smoking in high-risk situations.

Readiness to quit smoking was assessed by the "stages of change" question (Dijkstra, Roijackers, & de Vries, 1998c). Response categories were as follows: "intending to quit within one year" = 0: pre-contemplators; "within six months" = 1: contemplators; "within one month" = 2: preparers). The AP scale consisted of 17 items on preparatory plans and coping plans with responses on a five-point scale from 1 = "definitely not" to "5 = yes, definitely", Cronbach's $\alpha = .70$ (see the Appendix); responses were

summed (Te Poel et al., 2009). Items included "Are you planning to remove all tobacco products from the house?" A higher score reflected more planning.

Outcomes at Follow-up

The main outcome was smoking cessation at the six-month (T2) post-test, which took the form of online questionnaires. We assessed two smoking cessation outcomes, point prevalence abstinence (PPA) and continued abstinence (CA). To assess PPA respondents were asked: "Have you smoked during the last seven days, even one puff?" ("response categories": 0 = "yes, I have smoked;" 1 = "no, I have not smoked") (Velicer & Prochaska, 2004; Velicer, Prochaska, Rossi, & Snow, 1992). CA was measured according to the Russell standard (West, Hajek, Stead, & Stapleton, 2005). CA, which indicates that the participants had not been smoking for a larger period of time (scores: 0 = "smoking"; 1 = "not smoking"), was calculated on the basis of responses to two questions. Because the study was a smoking cessation induction trial (i.e., the intervention encouraged participants to quit, including those who were not planning to quit within a month) a grace period was given, allowing smokers one month from baseline to quit (Aveyard et al., 2009; Hughes et al., 2003b; West et al., 2005). Smoking no more than five cigarettes after the grace period (i.e., for five months) counted as abstinence.

Secondary outcomes were AP and execution of plans one month after baseline (T1) (see the Appendix for description of items). We measured these effects one month after baseline because it seemed likely that individuals would decide about quitting shortly after receiving the tailored letter and therefore AP would be more prominent at that time than after six months. The AP scale has been described above. Execution of plans was assessed by asking participants which of the 17 pre-defined actions plans, for example, "planning a quit date," "remove all ashtrays," they had executed in the past month, responses were binary ("yes" or "no"). The number of actions executed was summed to give a plan execution score (0 = no plans were enacted; 17 = all plans were enacted).

To evaluate the AP component of the intervention, participants in the experimental group were asked at T1 whether they had read the personal quit plan generated for them, and whether they had completed the IF THEN planning sheet (see *Intervention* section). For both questions response options were: 0 = "no;" 1 = "yes." Participants were subsequently asked whether formulating the plan had helped them to prepare a quit attempt (five-point response scale: 1 = "very little;" 5 = "a lot").

Participants in both groups evaluated the CT e-mail-letters at T1 using a 12-item questionnaire asking about, for example, the personal relevance of the letter and whether the advice was comprehensible, credible, and trustworthy (five-point response scale: 1 = "completely disagree;" 5 = "completely agree"); they also gave the advice letter an overall rating (ten-point response scale:

1 = "very bad;" 10 = "very good") (de Vries, Kremers, Smeets, Brug, & Eijmael, 2008; Te Poel et al., 2009).

Analyses

Logistic regression analysis was used to assess the effect of the AP intervention on smoking cessation. The outcomes were PPA and CA at T2, with group as the independent variable and the baseline variables as covariates ("enter" procedure). The latter was done to increase the power of the analysis by reducing unexplained variance (Robinson & Jewell, 1991). We conducted a complete cases (CC) analysis and an intention-to-treat analysis in which non-responders were treated as smokers (ITT). Interactions between group and stage of change, education and gender, variables that have been shown to influence intervention effects in other studies (Berndt et al., 2014; Connor & Higgins, 2010; Stanczyk et al., 2014) were tested by means of backward likelihood ratio tests.

The effect of the AP intervention on AP at T1 was assessed by linear regression analysis with AP score and plan execution score as outcomes and group as the independent variable. Baseline variables were used as covariates. Group differences in AP and coping plans were tested using independent sample *t*-tests.

Chi-square analysis was used to provide insight into the percentages of PPA and CA in participants categorized according to plan execution (low; moderate; high) and group. For the experimental group, we also performed a chi-square analysis comparing PPA and CA according to whether or not participants had completed the IF-THEN planning sheet. Group differences in evaluation of the intervention were assessed using analysis of variance (ANOVA).

RESULTS

Participant Characteristics, Randomization, and Attrition Analyses

The mean age at baseline was 38.8 years (SD = 11.4); 67.4% were women. Thirteen-point-nine percent of participants had a low education level, 49.4% a medium level, and 36.7% a high level. Most participants (77.1%) wanted to quit smoking within the next month. There were no baseline differences between the groups (Table 1).

Figure 1 shows enrolment and loss to follow-up. The dropout rate was 60.9% at T1 and 77.5% at T2. This high drop-out may have affected the estimation of effects, so baseline variables were included in all effect analyses (Tables 2 and 3) and two analyses of loss to follow-up were performed. A logistic regression analysis showed that participants lost to follow-up were younger (T1, T2) and more likely to be male (T1), less educated (T1, T2), have a higher addiction level (T2), no children (T1), or no partner (T2). These analyses also revealed that loss to follow-up was not associated with intervention group. The randomization check previously described (Table 1) was performed with the non-responders at T1 and T2 excluded. These analyses confirmed the "full randomization" check, indicating that there were no group differences in

TABLE 1. Baseline characteristics for experimental and control group ($N = 1982$, adult Dutch smokers)

	Control group ($N = 1005$) % (N)	Experimental group ($N = 977$) % (N)	<i>p</i> -value
Number of smoking-related diseases			.79
0	80.1% (805)	80.2% (784)	
1	18.1% (182)	17.3% (169)	
2	1.8% (18)	2.5% (24)	
Prior quit attempt			.11
Yes	87.7% (881)	85.7% (837)	
No	12.3% (124)	14.3% (140)	
Fagerström test (FTND)	$M = 5.0$ (SD = 2.5)	$M = 5.0$ (SD = 2.5)	.16
Stage of change			.43
Planning to quit within:			
1 month	78.2% (786)	75.9% (742)	.82
3 months	14.8% (149)	17.3% (169)	
6 months	4.1% (41)	4.3% (42)	
12 months ^a	2.9% (29)	2.5% (24)	
Pros of quitting	$M = 3.1$ (SD = .6)	$M = 3.1$ (SD = .6)	.19
Cons of quitting	$M = 2.4$ (SD = .6)	$M = 2.5$ (SD = .6)	.89
Self-efficacy	$M = 3.3$ (SD = .6)	$M = 3.3$ (SD = .6)	
Social influence modeling:			
Children	9.3% (93)	11.5% (112)	.16
Smoking	35.3% (355)	35.9% (351)	.99
Not smoking	55.4% (557)	52.6% (514)	
N/A	41.3% (415)	40.8% (399)	
Partner	37.1% (373)	37.9% (370)	
Smoking	21.6% (217)	21.4% (208)	
Not smoking			
N/A			
Action plans	$M = 3.7$ (SD = .5)	$M = 3.7$ (SD = .5)	.90

^aParticipants planning to quit in 6 or 12 months were categorized as one group in the regression analyses to have sufficient numbers of participants in the analyses.

baseline variables at T1 and T2 when non-responders were excluded (*p*-values from .11 to .89; no details provided).

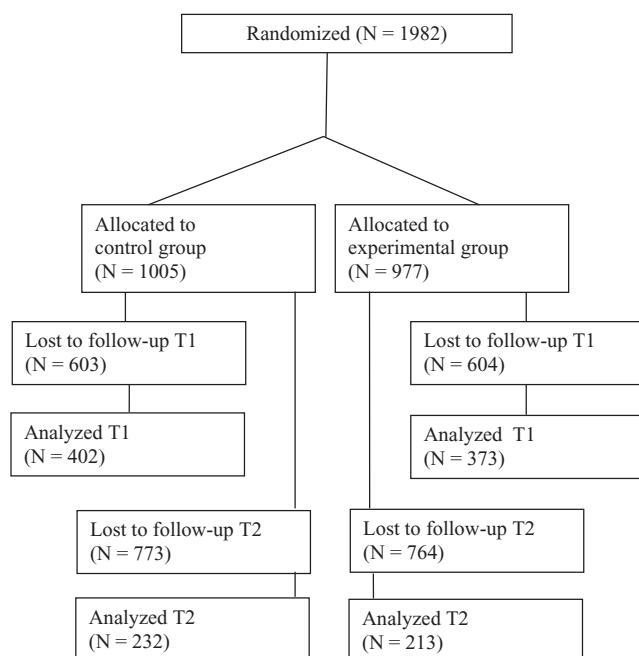


FIGURE 1. Consort diagram.

Effects of AP Intervention on Smoking Cessation

Logistic regression analysis on complete cases revealed a significant effect of the AP intervention on CA at six months; the ITT analysis revealed a borderline significant effect (Table 2). There were no significant group differences in PPA. Stage of change, gender, and education level did not moderate the effect of group on PPA or CA. Table 2 shows that in the CC analysis 16% of the experimental group met the criteria for CA compared to 10% of the control group; PPA was much higher (41.8% and 43.7%, respectively). In the ITT analysis, CA was 2.2% and 3.4% and PPA was 9.7% and 9.5% in the experimental and control groups, respectively.

AP, Execution of Plans, and Smoking Cessation

The independent sample *t*-tests (Table 3) showed that one month after baseline participants in the experimental group had made and executed more action plans than those in the control group (AP: $t(753) = 3.57$, $p < .001$; execution: $t(753) = 2.52$, $p = .01$). The same table shows that there was a small but significant effect of group on

TABLE 2. Quitting after six (T2) months (logistic regression analyses controlled for baseline variables; complete cases; and intention-to-treat analyses)

	Control group ^a (<i>N</i> = 232)		Experimental group ^a (<i>N</i> = 213)		95% CI		OR	Control group ^b (<i>N</i> = 1005)		Experimental group ^b (<i>N</i> = 977)	OR	95% CI	
					Lower	Upper						Lower	Upper
Point prevalence abstinence	41.8% (<i>n</i> = 97)		43.7% (<i>n</i> = 93)		.76	1.71	1.14	9.7% (<i>n</i> = 97)		9.5% (<i>n</i> = 93)	1.02	.75	1.38
Continued abstinence ^c	10.2% (<i>n</i> = 22)		16.3% (<i>n</i> = 33) (<i>p</i> = .06)		1.08	3.74 (<i>p</i> = .02)	2.01	2.2% (<i>n</i> = 22)		3.4% (<i>n</i> = 33)	1.68	.96	2.92 (<i>p</i> = .07)

^aComplete case analyses.

^bIntention-to-treat analyses.

^cNo. of cases varies due to missing values (control group *N* = 215; experimental group *N* = 199).

TABLE 3. Means and standardized beta coefficients of action plans and execution of plans at T1 ($N = 775$), controlled for baseline variables

Variable	Control group M	Experimental group M	C vs.E β
Action planning T1 ^a			
C ($N = 402$) E ($N = 373$)	3.62	3.75**	.10**
Execution of plans T1 ^b			
C ($N = 402$) E ($N = 373$)	6.51	7.22**	.08*

Note: * $p < .05$, ** $p < .01$.

^aMean score on a continuous scale ranging from 1 = definitely not, to 5 = yes, definitely.

^bIndex ranging from 0 to 17.

AP and plan execution such that participants in the experimental group had made and executed more plans.

Subsequent chi-square analyses of PPA and CA on the basis of complete cases and ITT showed that execution of plans was significantly associated with smoking cessation rate at six months in both groups (see Table 4).

Relationship Between IF THEN Plans and Smoking Cessation in the Experimental Group

One fifth (20.4%, $N = 76$) of the experimental group completed the IF THEN action planning sheet. Chi-square analysis revealed no significant differences in smoking cessation between those who completed the IF THEN sheet and those who did not. Using CC analysis PPA was 41.5% and 44.0% and CA was 16.2% and 16.6% for participants who did and did not complete the planning sheet, respectively. Using ITT analysis PPA was 22.45% and 24.6% and CA was 7.9% and 8.8% for participants who did and did not complete the planning sheet, respectively.

Evaluation of the CT Interventions

Table 5 shows that both groups were similarly positive about the tailored advice, although participants in the experimental group were more likely to report that the advice was personally relevant. At borderline significance

the experimental group evaluated the CT advice as more interesting, more understandable, more trustworthy, and a better reflection of their own opinion. Overall ratings for the advice were similar in the two groups with mean scores of 7.24 and 7.15 in the experimental and control groups, respectively.

DISCUSSION

This RCT showed that the AP intervention had a significant positive effect on CA in the CC analysis ($OR = 2.01$, $p = .02$) and a trend toward a positive effect on CA in the ITT analysis ($OR = 1.68$, $p = .07$). The AP intervention had no effect on PPA.

Because we found only two small effects (of which one was of borderline significance) across four indicators of effectiveness, it is difficult to draw conclusions about the efficacy of the AP intervention. The large dropout rate in our study (77.5%), which makes the ITT scenario too conservative and the CC scenario too liberal (Twisk & De Vente, 2002), also makes it difficult to draw firm conclusions. There is also no consensus on whether smoking cessation should be measured in terms of CA or PPA. PPA has the disadvantage that it only considers behavior at one point in time. Although some researchers consider PPA a valid measure of outcome (e.g., Velicer & Prochaska, 2004; Velicer et al., 1992) others do not (e.g., West et al., 2005). CA measures cessation over a period of time (Aveyard et al., 2009; Hughes et al., 2003b; West et al., 2005); in this study CA was defined as sustained abstinence over a five-month period, with a maximum permitted five cigarettes smoked during that period. We prefer to evaluate smoking cessation effects in terms of CA because it measures sustained abstinence while taking into account the dynamics of quitting; recognizing the possibility of relapse and allowing a grace period to accommodate delay in starting a quit attempt. Assuming that CA is the preferred outcome the small effects of our planning intervention are encouraging. Given the potential for widespread use of such web-based interventions, even small effects may have a considerable impact on public health.

TABLE 4. Quitting after six (T2) months related to execution of plans after one month (T1) (Chi-square analyses; complete cases and intention-to-treat analyses)

Plan execution ^{a,b,c}	PPA (%) ($N = 413$) ^b	PPA intention-to-treat (%) ^b ($N = 727$) ^a	CA (%) ($N = 385$) ^b	CA intention-to-treat ($N = 727$) (%) ^a
Control group ($n = 381$)				
Low ($n = 107$; 28.1%)	31.1 ($n = 19$)	17.8 ($n = 19$)	3.5 ($n = 2$)	1.9 ($n = 2$)
Moderate ($n = 184$; 48.3%)	44.1 ($n = 49$)	26.6 ($n = 49$)	11.8 ($n = 12$)	6.5 ($n = 12$)
High ($n = 90$; 23.6%)	50 ($n = 24$)	26.7 ($n = 24$)	15.6 ($n = 7$)	7.8 ($n = 7$)
Experimental group ($n = 346$)				
Low ($n = 82$; 23.7%)	26.3 ($n = 10$)	12.2 ($n = 10$)	8.1 ($n = 3$)	3.7 ($n = 3$)
Moderate ($n = 143$; 41.3%)	44.9 ($n = 35$)	24.5 ($n = 35$)	17.6 ($n = 13$)	9.1 ($n = 13$)
High ($n = 107$; 35.1%)	53.2 ($n = 41$)	33.9 ($n = 41$)	22.9 ($n = 16$)	13.2 ($n = 16$)

^aScale score range = 0–17; low = 0–4 / moderate = 5–9 / high = 10–17.

^b N = smaller due to missing values on the plan execution scores at T1 and CA, PPA scores at T2.

^cAll p -values $< .01$.

TABLE 5. Means and standard deviations (SD) on process evaluation items (T1) by group (*p*-values of *T*-tests)

	Experimental group (<i>N</i> = 373)*	Control group (<i>N</i> = 402)*	<i>p</i> -value
The letter was interesting	3.88 (.81)	3.77 (.77)	.07
The letter contained new information	3.03 (.97)	3.10 (.97)	.38
The content was personally relevant to me	3.61 (.86)	3.59 (.73)	.65
The letter was understandable	4.30 (.58)	4.22 (.64)	.09
My opinion was acknowledged in the letter	3.83 (.77)	3.73 (.65)	.06
The letter was related to my own situation	3.86 (.76)	3.75 (.68)	.04
The content of the letter was credible	4.03 (.64)	3.95 (.62)	.13
The content of the letter was trustworthy	4.03 (.66)	3.94 (.58)	.07
The letter was annoying	1.95 (.91)	1.90 (.85)	.45
The tone of the letter was irritating	1.84 (.81)	1.88 (.76)	.52
Overall evaluation of the letter	7.24 (1.10)	7.15 (1.09)	.27

Note. All items were measured on a 5-point scale (1 = fully disagree to 5 = fully agree).

*Participants who did not read the email letter (*N* = 40) or did not remember reading the email letter (*N* = 51) were excluded.

A comparable study (Elfeddali, Bolman, & de Vries, 2013) also failed to show that a CT web-based intervention including an AP component had a large effect on CA. Unlike intervention studies in which PPA was the main outcome indicator (Armitage, 2007, 2008; Armitage & Arden, 2008; Webb, Sheeran, & Luszczynska, 2009), we did not find an effect of the AP intervention on PPA. However, these studies are not directly comparable with ours owing to differences in the control conditions and in the intervention itself. In our study, the AP component was limited to guidance and the recommendation that participants develop IF THEN plans; in the other studies development of such plans was explicitly prompted and monitored. Another important difference was that our intervention was web-based whereas other AP intervention studies have used paper and pencil methods. The delivery method may have been responsible for the high dropout rate in our study and may have affected the results of the study. Dropout is a common problem in web-based intervention studies (Bennett & Glasgow, 2009; Elfeddali et al., 2012b; Etter, 2005; Eysenbach, 2005; Te Poel et al., 2009).

Why did we find only small effects on CA and no effect on PPA? The CA data suggest that the intervention was effective in prompting participants to quit shortly after exposure to the intervention and in helping them to persist with that quit attempt. The lack of effect on PPA suggests that the people who were only abstinent for a seven days period were less motivated to quit or wanted to smoke occasionally, while those who were abstinent from smoking for at least five months (CA) were more motivated quitters who were more likely to persevere with a quit attempt. Additional analysis revealed that this was not the case, 78% of the participants who were abstinent for, respectively, only seven days or for a five months period indicated at the baseline measurement that they wanted to quit within a month.

The small intervention effects suggest that the AP intervention was not sufficiently intensive; only one episode of AP guidance was provided. Other research has suggested that more than one web-based intervention episode is necessary to realize the benefits of AP advice and sup-

port (e.g., Borland, Balmford, & Hunt, 2004; Elfeddali, Bolman, & de Vries, 2012; Stanczyk, Bolman, Muris, & de Vries, 2011). It is likely that a more effective AP intervention would include prompting and monitoring AP and plan execution on an ongoing basis. Furthermore, it seems likely that our AP intervention was not sufficiently detailed; previous research suggested that quitters have to make very specific and detailed plans (Elfeddali et al., 2013; Kwasnicka et al., 2013; van Osch et al., 2008) and this kind of activity was not included in our intervention.

Another potential explanation for the small effect on CA is that the self-efficacy guidance in the control intervention also included tips on how to cope with difficult situations and these may have prompted participants in the control group to develop specific action plans. Moreover, the control group had to complete the AP questions at baseline and T1 and this may have had an unintended beneficial effect on AP and execution of plans in this group (Table 5 supports this possibility) thus reducing group differences.

The small effect on CA might also have been caused by the low proportion of participants in the experimental group completing the IF THEN planning sheet. In terms of effect this reduced the intensity of the AP intervention for the majority of participants. However, it is unclear that this influenced the efficacy of the AP intervention, we did not find differences in smoking cessation associated with completion of the IF THEN planning sheet. It is also possible that the intervention prompted participants to think about IF THEN plans even if they did not formalize such plans on the IF THEN sheet. It is also important to remember that the IF THEN planning sheet was one of the four components of the AP intervention.

Despite the ambiguous smoking cessation outcomes—effects on CA but not on PPA—there were small intervention effects on AP and execution of plans, and execution of plans was associated with smoking cessation, which is consistent with results of a previous study (de Vries et al., 2013).

In summary, the modest effects on smoking behavior, together with the effects on AP and plan execution sug-

gest that our AP intervention has potential but needs to be improved and intensified. On the basis of previous studies (e.g., Armitage & Arden, 2008; Elfeddali et al., 2012a, 2013; van Osch et al., 2008) and a recent systematic review (Kwasnicka et al., 2013), we propose a number of improvements.

A first needed improvement of the intervention is that smokers should be prompted to develop meaningful action plans and that planning is supported and monitored. Use of the IF THEN format has been shown to be helpful for this (Armitage, 2007, 2008; Armitage & Arden, 2008; van Osch et al., 2008). Planning can also be facilitated by suggesting pre-defined actions (Armitage, 2007, 2008). Second, support for AP and plan execution must be sustained over a period of time; this necessitates the use of multiple episodes of feedback or guidance, and attention to development and execution of plans during all phases of a quit attempt (de Vries et al., 2013; Elfeddali et al., 2012a; Stanczyk et al., 2014). Research is needed to identify the optimal number and frequency of intervention episodes to improve effects but also understanding of the dosage-drop-out problem.

There are a number of limitations to our findings. We did not verify self-reported smoking abstinence biochemically. However, the announcement of possible cotinine validation was assumed to yield a “bogus pipeline” effect (Aguinis, Pierce, & Quigley, 1993). Because this study did not include contact with a counselor and was therefore relatively undemanding, self-report measures of abstinence were considered reasonably accurate (Velicer et al., 1992).

The study was also subject to high loss to follow-up that was shown to be related to factors associated with success in quitting (e.g., addiction level). This may have biased the results, but we believe the high dropout rate had relatively little impact because there were no intervention group differences in dropout and we took baseline variables such as addiction level into account as covariates in the effect analyses. Nevertheless the high dropout may mean that the ITT analysis produced an overly conservative estimate of the effects of the AP intervention (Twisk & De Vente, 2003). High dropout rates are a common problem in web-based health-related intervention studies (see, e.g., Bennet & Glasgow, 2009; Elfeddali et al., 2012b; Etter, 2005; Eysenbach, 2005; Te Poel et al., 2009). The high dropout rates may be caused by invalid e-mail addresses and spam filters, but it may also be the case that smokers who have quit successfully do not want to be reminded of their former smoking behavior (Strecher, 2007) or conversely smokers who do not manage to quit stop participating because they feel they are failing.

CONCLUSIONS

This study was one of the first to assess the effects of supplementing a web-based smoking cessation intervention with advice and guidance on AP. There was no clear evidence for the efficacy of the AP component as a supplement to the standard CT intervention. It is however encouraging that we found a small effect on smoking be-

havior and effects on AP and plan execution. The potential for widespread use of web-based interventions means that even small effects may have an impact on public health. It is suggested that the design of the intervention should be improved.

Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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GLOSSARY

Action planning: strategies that an individual makes to reach and maintain a certain behavioral change goal.

Computer-tailored feedback: intervention strategy that refers to the provision of automatized personalized feedback on issues that are related to the behavior that the receiver wants to change. Computer-based data-driven decision rules form the base to automatically adapt feedback to the personal characteristics of the receiver.

Coping planning: draft of actions that a person plans in terms of coping strategies when coming into a difficult situation that may endanger the maintenance of the newly acquired health behavior.

Plan enactment: actual implementation, application of plans.

Preparatory planning: draft of actions that a person plans to undertake to prepare the behavioral change attempt.

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APPENDIX

Scales on, respectively, action planning and execution of plans

Introducing question on action plans (baseline and T1):

Quitting smoking can be dealt with in several ways. Below you find a number of possibilities. Which possibilities do you plan to use?*

Introducing question on execution of plans (T1):

Which of the following actions have you executed in the past month?

Action plans: do you plan to...*

- break/change smoking related routines?
- never smoke again, not even a puff?
- read information about smoking cessation?
- do something else when you crave a cigarette?
- think about how to prevent weight gain?
- think of difficult situations you might encounter after quitting?
- remove all tobacco products from the house?
- plan a quit date?
- quit immediately without cutting back first?
- reward yourself after quitting?
- inform people in your environment about your quit attempt?
- use smoking cessation aids?
- avoid difficult situations that you might encounter after you quit smoking?
- make no-smoking agreements with your housemates?
- remove all ashtrays from the house?
- ask your guests not to smoke when you have only just quit?
- quit together with someone else?

Answering categories:

* 1 = definitely not, 2 = not, 3 = neutral/I do not know, 4 = yes, 5 = yes, definitely

** 0 = no; 1 = yes; 9 = not applicable (latter is categorized as missing)

Plan enactment: have you executed your plan to...**

See questions in the left of the table